HABIT-CHANGE

Toolset for adaptation of management
A manual for the CAMP process

15/11/2011

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<tr>
<td><strong>Further information</strong></td>
<td><a href="http://www.habit-change.eu">www.habit-change.eu</a></td>
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1. Introduction, objective and method

1.1. Introduction

In the project-proposal this output is described as a “step by step guideline for managing the most common changes due to climate change”. The term “toolset” has to be understood in a metaphoric way as a guideline and manual for the process of adapting existing management plans within the HABIT-CHANGE project. With this “toolset” we enable those investigation areas of the HABIT-CHANGE project that develop a “climate-change adapted management plan” (CAMP) to organise the process of adaptation. With this output we provide a set of methods to be applied during the adaptation process and detailed explanations for each working-step within the adaptation process.

1.2. Objectives

The main objective of this output is to enable the investigation areas that develop a climate-change adapted management plan (CAMP) to organise and lead the process of adaptation sovereign and independent. Therefore a profound knowledge and understanding of the process itself, its aims and methods is necessary. With this report, called “toolset”, we provide to all HABIT-CHANGE CAMP areas basic information about substantial contents, methods and approaches. We highlight how different sets of information as they were elaborated within the HABIT-CHANGE project should be included in the process of adaptation and used for the climate-change adapted management plan.

The main objectives of this output are:

- Enable the responsible project partners to develop a climate-change adapted management plan (CAMP)
- Give detailed descriptions for the basic working steps of the adaptation process
- To explain methods for each working steps, for example: how to produce potential impact maps
- To draw lines and links to outputs and reports of the HABIT-CHANGE project that should be used within the adaptation process

1.3. Method

Relevant literature was analysed and different methodologies discussed. A wide variety of different approaches for adaptation to climate change can be found in literature. Nevertheless none of them could be transferred directly to the HABIT-CHANGE Project. This is partly because terms and definitions are used in a divergent way, especially basic terms like sensitivity, vulnerability or risk. Also, most strategies and methodologies for adaptation in nature conservation are not focussed on the habitat level, but on species or more generalised ecosystem-categories.

Relevant approaches were discussed between scientific partners and some main principles of adaptation that are common to most approaches were adopted for the CAMP process. The respective sources are represented by some quotations and in the literature list at the end of the document.
2. General goals and structure of a CAMP

As one of the core outputs in the HABIT-CHANGE project climate-change adapted management plans (CAMPs) will be elaborated. CAMPs will provide rules for decision making under conditions of climate change and support all management and adaptation processes in protected areas. They contain target values and threshold values that indicate when specific management action has to be taken to mitigate the effects of climate change. They will contain specified advice on how to implement the concept of “active adapted management” in the protected areas, including frequent monitoring of the achievement of objectives and adaptation of measures and strategies. CAMPs shall be a central information source and working basis for administrations of protected areas and can serve as an example for the adaptation of management plans in other protected areas in Central Europe.

Seven partner regions have been selected for the analysis and adaptation of their existing management plans (partly or in whole) regarding their sustainable design in the context of climate change. The regional practice partners will adapt their plans to identified requirements using new strategies and measures. They are supported by the scientific partners of the HABIT-CHANGE project.

CAMPs will be elaborated for the following investigation areas:

- Balaton Uplands National Park
- Biebrza National Park
- Danube Delta Biosphere Reserve
- Körös-Maros National Park
- Šečovlje Salina Nature Park
- Triglav National Park
- (Bucegi Natural Park?).

The methodological approach contains 5 basic working steps, which need to be done one after another. Constant stakeholder involvement should accompany the CAMP process (see Figure 1).

Each of these working steps consists of a varying number of tasks and communication processes. Although the working steps are based on each other it will be necessary to update the information repeatedly. Like in all planning processes the working steps have to be completed by iteration. In addition to the basic working steps optional working steps can be included in the CAMP process. These optional steps are either needed to provide relevant background information (e.g., habitat maps) for basic steps or are useful assets adding further helpful content to the CAMP.
Figure 1: The working steps of a CAMP process
3. Working steps and methods for the adaptation of management plans

The basic working steps are described and explained in the same structure: in the introduction some basic principles are and the context within the process of adaptation are described. These explanations are followed by a brief description of goals and the expected outcome. In the “method-section” it is explained how these goals can be achieved. Usually there are more methods that may be used to obtain the goals but in order to use the same approach in all CAMP-area only a limited selection of applicable methods is presented here. Each chapter closes with a list of minimum requirements that should be achieved by all CAMP-areas.

3.1. Basic working steps

3.1.1. Identification and definition of the objectives and scope of CAMPs

Introduction

As a first step in the CAMP process the objectives and expectations of the specific investigation area should be defined and documented. In this step content-related and structural decisions must be made. It should be documented who (which stakeholder) was involved in discussion and decision-making and what alternatives were discussed.

Decisions related to CAMP content:

- The area to be considered in the CAMP (e.g., the entire protected area, only single habitats, single species) must be defined.
- The objectives of the conservation management (e.g., maintaining a “favourable conservation status” for Natura 2000 sites, maintaining a critical minimal habitat/population size until 2050) must be documented.

Decisions related to CAMP structure:

- The scope and depth of the impact assessment (e.g., eco-physiological impacts on habitats, social impacts on tourism, and economic impacts on local communities) must be defined.
- The needed skills and data of the team working on the CAMP must be described.

These decisions will set the content and formal structure of the CAMP. In HABIT-CHANGE most of these decisions have already been made during the discussion of our partner meetings, but the local specifics in investigation areas need to be documented.

The main aim of the adaptation of the habitat management in HABIT-CHANGE investigation areas is to maintain or obtain a “favourable conservation status” of protected habitats (FCS, see Habitats Directive EU 92/42) even under the conditions of climate change. The CAMP has to define strategies and measures to obtain this objective. The revision of existing goals, strategies and measures
concerning their suitability for changing climates is a basic requirement of the CAMP process, too. It is also important to identify uncertainties and to point out how the investigation areas can deal with them.

**Goals and expected outcome**

This first working step is the definition and description of:

- the area and objects to be considered in the CAMP,
- the objective of the conservation management for this area/object,
- the scope of the impact assessment,
- the adjustment of the necessary steps for the CAMP process (basic and optional working steps),
- the planned structure and outline of the output (e.g.: The CAMP will be a supplement to an existing plan. It will contain a text-document with approximately NN pages and maps that show ...,) and
- the skills of the team working on the CAMP.

**Methods**

The definition and specification of objectives is basically a discussion and decision process. There can be three different levels of stakeholder inclusion (see also 3.1.4 below):

a.) discussion within the protected areas administration,

b.) discussion within the administrative community including local NGOs and related administration (e.g., forestry) or

c.) discussion with the wider public (e.g., local land user, politicians).

In the most elaborated form all three steps are included in an iterative process to define CAMP objectives. Especially the discussion with the wider public can also be used to identify factors to be considered in the CAMP process.

The decision should be taken in a joint meeting, but can be prepared by sending out questions to relevant decision makers. The questions to be discussed are:

- Which area or part of the protected area should be considered in the CAMP? Should it be limited to special features (e.g., habitats considered most sensitive) or cover the whole area?

- What is the objective of the conservation management for this area/object under changing climate? What status should this area/object have in the year 2050?
- What are driving forces (e.g. the GAP of the EU or national legislation) that need to be considered in the CAMP process?

- How should the results of the CAMP be presented? Should it be a separate plan, an additional chapter for existing documents or integrated in new management plans?

The decision on area, objective and scope should be documented in a protocol (e.g., supplemented by a map).

**Minimum requirements**

A discussion within the administration of the protected area regarding the objectives for the CAMP process and the selection of stakeholders that shall participate the process of adaptation (one meeting of at least 1.5 hours).

A documentation of the decisions taken regarding area/objects to be considered, objectives of conservation management for the future development of these area/objects and the scope of the CAMP process.

### 3.1.2. Inventory taking of existing data

**Introduction**

"The primary purpose of natural resource inventories is to document the presence of resources in parks, and to assess and document the current condition and knowledge of natural resources in the parks. Inventories allow comparison of existing conditions to reference conditions or the desired state of parks and establish a solid baseline for making scientifically sound management decisions and for designing long-term monitoring plans that track the health of key park resources. Beyond informing management, inventories foster education and stimulate people’s innate fascination with the natural world. Parks more than ever serve as natural laboratories for scientists, important refuges of biodiversity, and tranquil oases for visitors. Natural resource inventories place park resources into a broader world view and provide ecological context." (NATIONAL PARK SERVICE 2009, 1)

**Goals and expected outcome**

Already existing data about habitats, historic land-use, property rights, existing climate or hydrology can be used in further steps, e.g., to assess sensitivity of habitats, potential range of distribution, potential impacts of climate change. Beside the management plan for the protected area more specific information might exist in the areas concerning for example soil, habitats, species or hydrology. In this working steps it is not planned to produce new and additional maps and documents, but to use as much of the existing data as possible.
According to National Park Service (NATIONAL PARK SERVICE 2009, 3) the following “12 basic inventories were deemed to provide the minimal set of natural resource information needed by managers and planners to effectively manage and protect park resources."

Table 1: Essential information and objectives for a basic inventory of conservation areas
(Source National Park Service 2009, 7 pp.)

<table>
<thead>
<tr>
<th>Basic Inventory</th>
<th>Information and objectives of the Inventory</th>
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<tbody>
<tr>
<td>Natural Resource Bibliography</td>
<td>● discover, compile, and organize existing records, reports, maps, photographs, manuscripts, gray literature, and other historical scientific information to a comprehensive, centralized database</td>
</tr>
<tr>
<td>Base Cartography Data</td>
<td>● need access to and support from a geographic information system to facilitate decision-making and resource protection; cartographic information provides geographic information systems (GIS) data layers ● acquires, processes, and distributes GIS data that complement other inventory projects, as well as many GIS mapping and analysis projects throughout ● used &quot;for many different applications, ranging from making maps, to spatial data verification, to designing monitoring sampling frameworks ● acquire the suite of cartographic data products parks require in order to prepare map products and to undertake a wide variety of geo-spatial analyses and support activities associated with the use of those products by parks</td>
</tr>
<tr>
<td>Air Quality Data</td>
<td>● require monitoring to determine current conditions in relation to standards or limits that are designed to protect human health and sensitive vegetation</td>
</tr>
<tr>
<td>Air Quality Related Values</td>
<td>● completion of inventories for vegetation, water resources, and vertebrates and vascular plants ● information about locations, thresholds of sensitivity of air quality related values: (1) species of flora and fauna potentially sensitive to air pollution and acid deposition (including invertebrate species), (2) sensitive ecosystems and ecosystem processes, (3) sensitive soils and surface waters, and (4) scenic vistas</td>
</tr>
<tr>
<td>Climate Inventory</td>
<td>● most ecological processes and many species strongly respond to climate variability ● current and historical data on climate are fundamental to interpreting past ecosystem changes and to predicting future changes ● describe the climatic setting by compiling basic data on key climatic parameters (e.g., annual precipitation, relative humidity, prevailing wind speed and direction, temperature variability)</td>
</tr>
<tr>
<td>Geologic Resources Inventory</td>
<td>● geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults ● geologic processes include erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rock falls, landslides, and shoreline change</td>
</tr>
<tr>
<td>Soils Resources Inventory</td>
<td>● provide the basic information needed to manage soil sustainability in parks and to protect water quality, wetlands, vegetation communities, and wildlife</td>
</tr>
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| Water Body Location and Classification | • predict the behaviour of a soil under alternative uses, its potential erosion hazard, its potential for ground water contamination, its suitability for control of non-native plant species and establishment of native communities, and its potential for preservation of cultural sites and landscapes  
| | • information about the physical, chemical, and biological properties of the soils, as well as information regarding potential uses and limitations of each kind of soil type  
| | • provide information useful for a wide variety of park planning, monitoring, resource condition assessment, management decision-making, and interpretation and outreach purposes  
| | • focus on the locations of streams, lakes, wetlands, and groundwater and water quality use classifications  
| Baseline Water Quality Data | • provide descriptive water quality information  
| | • summarizes a wide variety of water quality status and trend information  
| | • need to ensure that the physical, chemical, and biological characteristics of their waters sustain healthy aquatic ecosystems  
| Vegetation Inventory | • information on plant species and communities  
| | • manage challenges such as non-native species, insect outbreaks, and diseases; and to understand resources and processes such as wildlife habitat relationships and wildfires  
| Species Lists | • basic information on the occurrence and status of species  
| | • information about threatened and endangered species and non-native species  
| | • species of vascular plants and vertebrates (birds, mammals, fish, amphibians, reptiles) - because information was more readily available, taxonomy and field methodologies were better developed, and because they are more often the focus of park management actions or concerns compared to other species groups  
| Species Occurrence and Distribution | • information about which species were present, their geographic and ecological distribution, and the relative abundance of species  
| | • basic information about the occurrence, distribution, and relative abundance of vertebrate and vascular plant species  
| | • describe the distribution and relative abundance of high-priority species of special concern, such as Threatened and Endangered species, non-natives, and other species of special management interest  
| | • provide the baseline information needed to design protocols for long-term monitoring of the condition of selected species and communities  

"As a result of climate change, [...] there is a greater-than-ever need for natural resource data and information needs by park managers, planners, educators, and interpreters to allow the Service to more effectively confront and mitigate threats to the park and operate more effectively in political and legal arenas. The priority data and information will need to be updated for some parks as a result of increased knowledge and sophistication, as well as to new partnership and management
opportunities that arise because of climate change and other emerging issues." (NATIONAL PARK SERVICE 2009, 29)

"Data on species composition and distribution; rates of freshwater discharge into estuaries; river flooding regimes; magnitude and timing of anadromous fish runs; forest fire regimes; and home ranges, migration patterns, and reproductive dynamics of sensitive organisms would all be useful for making management decisions given the potential effects of climate change (Joyce and others 2008; Scott and others 2008; Peterson and others 2008; Palmer and others 2008)." (WEST et al. 2009, 1003)

Methods

Guiding questions for this working step are: What types of information are already available in CAMP areas? What kind of data and maps is needed for the adaptation process (e.g., the assessment of potential impacts, habitat sensitivity, strategy adaptation and potential habitat changes)?

Existing data should be compiled in an inventory or database. Wherever possible, digital data should be provided for GIS applications and the support of scientific partners.

Minimum requirements

All existing data and maps should be described as detailed as possible: when was the data collected, how old is the information? What scale are maps? Are data and maps available in digital version or only analogue, what data can be used for GIS? What methodology was used for the data collection?

1. Information about the protected habitats (according to Annex 1, EU Directive 92/42) in our investigation areas: Habitats maps with information about their extent, distribution, conservation status. Validation of habitat information: is it up-to date and complete or outdated?
   - Is information about habitat classification according to national standards compatible to the classification of the Habitats-Directive?
   - Is information about the protection status according to national “Red-Lists” available?
   - Information about hydrological aspects (water quality, water stands, water temperature)
   - Soil data (with maps)
   - Topographic information: elevation, slope, exposition etc.

2. Information about the historic development of the protected habitats: since when do the habitats exist, how did their status change in the recent years? This information could be related to the development of climatic parameters for projections of future development.

   - Scenarios / projections for climate change/ climate variables
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- Special micro climatic situation

4. Information on **existing pressures and drivers** that conflict the achievement of a favourable conservation status. Existing conflicts and problems with land-users and stakeholders.
   - Which factors shape the current distribution of habitats?
   - Current land-use practices: how are protected habitats managed or used? Who are the land-users, what goals do they pursue? Are they informed about the conservation goals?
   - „ [...] you need to identify the direct threats that influence your targets. Direct threats are primarily human activities that immediately affect a target (e.g., unsustainable fishing, hunting, oil drilling, construction of roads, pollution or introduction of exotic invasive species), but they can be natural phenomena altered by human activities (e.g., increase in water temperature caused by global warming) or natural phenomena whose impact is increased by other human activities (e.g., a potential tsunami that threatens the last remaining population of an Asian rhino).“ (THE CONSERVATION MEASURES PARTNERSHIPS 2007, 10)
   - non-climate-related threats (e.g., invasive species, habitat loss, fragmentation, overharvest) because “in many cases, climate change may exacerbate the effects of other threats” (LAWLER 2009, 81)

5. Information about planed and implemented **management measures** to obtain a favourable conservation status of protected habitats.
   - What management measures are planed and implemented by nature-conservation authorities, what measures are planed and implemented by other land-users and stakeholders?
   - Is information about the success of measures available? Is the implementation of measures monitored? Are measures evaluated regarding the effectiveness and efficiency?
   - Are different alternative measures implemented in one habitat-type to obtain conservation targets to find out what measure works best?

6. Information about applied **monitoring techniques and indicators** in use to monitor the development of protected habitats.
   - Is there a specific monitoring system established for protected habitats?
   - What information from monitoring programs for species can be used for habitat monitoring?
   - What information was gathered by permanent and frequent monitoring programs, what information was gathered by one-time monitoring that is not continued?

7. Information about already observed **impacts of climate change** on protected habitats.
• Has the conservation status changed recently?

• What changes have been observed? Can they be related to a specific pressure (for example a drought period, a wildfire, heavy rains, land-use changes due to climate change etc.)?

8. Information about the habitat sensitivity to climate change, to temperature and moisture changes. Which habitats are very sensitive to rising temperatures, declining precipitation or droughts? Information from literature reviews, observations or modelling?

• Which habitat types are most sensitive under climate change?

• Is sensitivity information available for characteristic plant species of protected habitats?

• Is sensitivity information from national “Red-Lists” of endangered species and habitats?

• Example for a possible approach: “Data on the sensitivity of habitats to climate change were not readily available, so the characteristic plant species of a habitat were used as proxies for that habitat. Plant species were chosen as, by virtue of their sedentary nature, they are likely to most accurately reflect the responses of a habitat to climate change. Data from the EU Habitat Interpretation Manual (EC 2007) were used to identify characteristic species and, again, bioclimatic envelope model outputs were used in the assessment process.” (HARLEY 2011, without page number; see also HARLEY et al. 2010)

9. Information about possible reactions to climate change: what measures and strategies are required or are available to battle climate-change impacts in protected areas?

• What reactions are recommended in national guidelines and adaptation strategies?

• What are the (long-term) implications for nature conservation and climate change mitigation?

With the information listed, some important components for vulnerability analyses can be filled: exposure and sensitivity. If adaptive capacity should be assessed, either the capacities for autonomous, spontaneous adaptation of habitats have to be defined (requiring information on the genetic variations of significant species, historical and physiological thermal and hydrological niches of significant species, information on mobility and dispersal of species and habitats) or the adaptive capacity only focuses on planned adaptation, e.g., management measures to maintain habitats, available resources for research, management of areas and implementation of measures, acceptance for adaptation measure within stakeholder- and land-user groups, legal framework and financial resources for management (e.g., CAP of EU and national programs in agriculture, forestry, fishery and nature conservation).

Data management

“One of the most critical aspects of good adaptive management involves managing the data [...]. Establishing and using a consistent data management framework will enable more effective use of
the data. [...] And finally, it is critical to ensure that data remain useable through time given the inevitable institutional memory loss and staff turnover” (TNC 2007, 120)

Advantages of properly managed data (TNC 2007, 120):

- Enables to explore the source, quality, and details of the underlying data behind decisions and therefore help to explain how and why results were achieved (or not achieved).
- Facilitates the engagement of stakeholders through easy understanding and sharing of data.
- Helps to generate more comprehensive and attractive information products.
- Provides a clear rationale on what data gaps exist and why these need to be addressed.
- Helps to ingest standardized data from external sources and integrate them with internal data
- Improves transparency, accountability and learning by being able to retrace what data came from where.

Development and regular use of systems for recording, storing, processing and backing up project data: “You need to have methods and systems established for recording, storing, and processing data. This includes processes for systematically checking, cleaning, and coding raw data as soon as you get them and for storing and backing-up your data” (THE CONSERVATION MEASURES PARTNERSHIPS 2007, 23). So a concept for the data management needs to be developed. All participating partners in the adaptation process should have access to all data available. The following questions need to be answered:

- Data storage: where can data be stored so everybody has free access?
- What data standards need to be defined?
- Translation of names, labels and designations into English

Key steps for a successful and effective data management (TNC 2007, 122ff.):

1. Develop a table of the data sets you expect to have (What data the project will collect? How and where data will be stored? Who will use the data?)
2. Designate data managers (Who will collect and manage the data?)
3. Develop codebooks, protocols, and databases for different kinds of data (specify how you will record each piece of data in a consistent and specific way; figure out protocols for transferring data from collection points to the project’s databases and then to the ultimate users; develop your long-term databases for different types of data: e.g., Geographic Information System for spatial data, Excel or Access for quantitative tabular data)
4. Develop metadata for all data products (Tools for developing metadata are available online at http://conserveonline.org/workspaces/metadata/metadata_tools)
5. Review and transcribe data on a regular basis (transcribe your data as soon as possible after collecting it as a part of normal operating routine)

6. Clean and backup data (catch any errors that were introduced during the collection, coding, or transcription processes; find gaps that may indicate missing date)

7. Use and share data (for example, contribute your data to larger data sets)
Table 2: Already existing data compilation, results from the HABIT-CHANGE working progress

<table>
<thead>
<tr>
<th>working-step</th>
<th>question</th>
<th>content and objective</th>
<th>output no.</th>
<th>comments</th>
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</thead>
<tbody>
<tr>
<td>Habitats maps</td>
<td>What protected habitats according to the EU Directive 92/42 exist in our investigation areas?</td>
<td>size and distribution of protected habitats in investigation areas: basis for sensitivity analysis</td>
<td>3.1.6; 3.1.7; 3.1.9</td>
<td>according to output-list only available for Körös-Maros, Bucegi, Balaton-Uplands, Secovlje Salina</td>
</tr>
<tr>
<td>habitat assessment</td>
<td>What state are the protected habitats in, how has the state changed recently?</td>
<td>topical information on conservation status, naturalness, historic development: basis for assessment of climate impacts</td>
<td>3.1.6; 3.1.7</td>
<td>Information about historical development of habitats is not planned, conservation status according to EU standard-data-forms sufficient?</td>
</tr>
<tr>
<td>climate maps</td>
<td>How is the climate in our investigation areas today, how will it be in the future?</td>
<td>existing conditions, historic data, future projections: basis for correlations between climate and habitat development</td>
<td>4.4.3, 3.2.3, 3.2.7, 4.5.2, 4.5.3</td>
<td>Information for Hungary available. Output 4.4.3 is planed as a list, not a map.</td>
</tr>
<tr>
<td>pressure and driver analysis</td>
<td>What land-uses and pressures stand contrary to nature conservation goals in protected areas, what conflicts a favourable conservation status of protected areas?</td>
<td>existing pressures and drivers that conflict a favourable conservation status of habitats and responsible land-users and stakeholders: existing conflicts and problems in investigation areas and starting points for management measures</td>
<td>3.1.2; 3.1.3; 3.1.5; 3.1.8; 3.2.1; 3.2.2;</td>
<td></td>
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<tr>
<td>list of management measures and objectives</td>
<td>What is done today in protected areas to obtain a favourable conservation status of protected habitats?</td>
<td>actions planned and implemented to reach a favourable conservation status, identification of topical objectives in protected areas</td>
<td>3.3.1</td>
<td>not all investigation areas have answered the questionnaire management measures yet</td>
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<tr>
<td>working-step</td>
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<td>content and objective</td>
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</tr>
<tr>
<td>monitoring analysis</td>
<td>How are changes in protected areas monitored today? What indicators are in use?</td>
<td>topical monitoring techniques and indicators to track changes and effectiveness of management measures: established indicators</td>
<td>3.1.4</td>
<td></td>
</tr>
<tr>
<td>climate change impacts analysis</td>
<td>How will the abiotic conditions for protected habitats (e.g. soil moisture) be affected by changes in temperature and precipitation?</td>
<td>impacts of climate change on protected habitats: correlation between changes in protected habitat and changes of climatic parameters</td>
<td>3.2.2; 3.2.3; 3.2.4; 3.2.5; 3.2.7; 3.4.1; 3.4.2; 3.4.3</td>
<td></td>
</tr>
<tr>
<td>sensitivity analysis</td>
<td>Which habitat-types in protected areas react in which way to climate change (and due to already existing pressures and drivers)?</td>
<td>How do protected habitats react (already or predicted) to changes of temperature and moisture: results of swim modelling?</td>
<td>4.3.5</td>
<td></td>
</tr>
<tr>
<td>management responses to climate change</td>
<td>How can protected area management (generally) react to projected changes and impacts?</td>
<td>management measures that may buffer climatic changes and strengthen resilience, change of objectives, zoning and stakeholder dialogue</td>
<td>3.1.5</td>
<td>suggested adaptation measures for nature conservation (relevant for adaptation of management plans, planed adaptation measures of important land-users (that might become additional pressures and drivers for protected habitats)</td>
</tr>
<tr>
<td>adaptation of management plans</td>
<td>What needs to be done in our investigation areas? How has the management plan to be adapted?</td>
<td>adaptation of objectives, measures, zoning and stakeholder dialogue to cope with climate change in protected areas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.1.3. Evaluation of existing management plan

Introduction

To create a CAMP it is indispensable to know the actual management plan in detail. It can serve as a fundament, but has to be reviewed thoroughly, especially with regard to climate change. This facilitates a revision that can fill gaps, draw new conclusions and build new connections between different aspects.

A management plan not only conduces to compare the current state of management with the requirements of the plan, but also normally includes a goal or an ideal state of a future situation that should be achieved. Hence after the implementation of the management plan, the following questions have to be addressed after certain periods: Has the present state already fulfilled this goal/ideal? Or have the circumstances changed? Is the goal still up-to-date? With regard to climate change, the original goals could have changed, because of shifted environmental circumstances. Even if the goal stays the same, the process of reaching the goal could have changed, because climate change could create new obstacles.

In short, with climate change the initial criteria for management have changed, thus the composition of flora and fauna, and that’s why the management plan has to be adapted.

Preferably the plan also provides methods, rules and directions, maybe even a time schedule or plan of procedures to reach the described management goals. To ensure a concise implementation, the following questions have to be addressed regularly:

- Did the management implementation follow the plan?
- Did it use the proposed methods and rules?

Evaluation of Goals/expected outcome

The second basic working step deals with the evaluation of existing management plans. Especially objectives, strategies and measures concerning habitats shall be analysed. For the development of a CAMP it is important to screen the management plan and to identify useful or missing information.

The evaluation report or documentation should include answers to the following key-questions:

- After choosing an area for a CAMP: what objectives, strategies and measures are described in the management plan for the selected area and habitats?
- Are there any implemented measures and strategies that are not mentioned in the management plan?
- Are the impacts of measures monitored? Are there any monitoring activities described in the management plan?
• Does the plan contain any climate or climate-change information?
• What role has the management plan for the topical management practice?

Methods

The IUCN-WCPA Protected Management Effectiveness Framework (Hockings et al., 2006) provides an overall structure and guidance on the purpose of management effectiveness evaluation, the selection and measurement of indicators and the analysis and use of the data.

Hockings’ circle (Fig. 2) shows how all elements of evaluation are connected with each other. **Context** stands for the current condition of the protected area and all the influences it has to tread with, it is an overview of the status quo and the potential future options. From this basic conditions **planning** has been or should have been set up, facilitating an overall goal for the development of the protected area, but also certain specific objectives and strategies to work with. At this point evaluation gives important feedbacks, if planning is distinct enough. It makes a note if it is too sophisticated and not realistic or vice versa if it is too little ambitious.

Planning triggers the need of resources, which serve as **inputs** to a most favourable **process** of developing the objectives of the area. Evaluation here can show for example if resources are used in an effective way, or if they are wasted with no valuable outcome on one hand. On the other hand evaluation takes a sharp look on the performance of processes, e.g. in how far current processes are communicated between all partners involved to speed them up and to give them more quality.

Management always delivers **outputs**, which have certain effects on planned objectives but also side-effects resulting in new processes and needs, which were not planned. Evaluation also detects major bias here and contributes new ideas of where to focus within the **outputs** for publicity and how to seize the new conditions. (Hockings et al., 2006, 11)
The author states that “clear and appropriate objectives for the protected area, supported by a management plan and adequate resources, are characteristics of effective management.” Evaluation studies take precise looks on the quality of plans, meaning their actuality, clarity and practicality, but also the presence of values and the relevance of planned actions. Hockings furthermore stresses on the need of a permanent evaluation system that feeds back into management decisions and shows how thoroughly its results and ideas are implemented and assessed. (Hockings et al., 2006, 20)

Recent research by Kapos et al. (2009) and Grantham et al. (2010, both cited in Bottrill et al. 2011, 2) shows that evaluation can to identify successful interventions and modify those that are less effective through a process of continuous learning. After Hockings et al. (2006, 13) one can add, that evaluation often needs to update and interpret available data, using this expansion to show how well protected values identified in the management plan are conserved.

Leverington and Harper (2000) identified four themes of management: protection of natural and cultural resources; presentation (including the provision for recreational use and interpretation); community involvement and relationships; and management capacity, which is the basis of the three previous and has to be improved at first. They also identified five levels of possible service delivery (see Table 3).
Table 3: Five levels of service delivery for protected area management (Leverington & Harper, 2000)

<table>
<thead>
<tr>
<th>Service Delivery</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Regressive</td>
<td>Gradual reduction in the condition of the protected area system. Not meeting statutory obligations or community expectations. Asset base deteriorating.</td>
</tr>
<tr>
<td>2. Caretaker</td>
<td>Maintaining the overall condition of the protected area system at existing standards. Meet only most basic statutory obligations. Urgent threats attended to, but few planned and consistent management programs undertaken.</td>
</tr>
<tr>
<td>3. Basic</td>
<td>Meeting priority statutory obligations and basic community expectations for management, including implementation of the good neighbour policy and periodic refurbishment of existing infrastructure, plant and equipment.</td>
</tr>
<tr>
<td>4. Enhanced</td>
<td>Allows sound management of protected areas with some additional infrastructure to support natural resource and visitor management with increased visitor and tourism opportunities.</td>
</tr>
<tr>
<td>5. Best practice</td>
<td>Optimum park management consistent with national and international best practice standards.</td>
</tr>
</tbody>
</table>

In general, sustainable success in conservation management comes from a both top down and bottom up approach. This view has been supported in the work of Leverington and Harper (2000, 206-207). After them, management improvements should be well understood from the leading forces, as well as from those who implement them in the field work. Regarding this, also cultural values will be successfully included and communicated with the community partners. Their approach leads also to an elaborated adaption of good practice examples of the past and to courageous changes where they are really needed.

Leverington et al. (2010, 24) lists following questions as a starting point of evaluation:

- Is there a management plan and is it being implemented?
- Have objectives been agreed?
- Does the planning process allow adequate opportunity for key stakeholders to influence the management plan?
- Is there an established schedule and process for periodic review and updating of the management plan?
- Are the results of monitoring, research and evaluation routinely incorporated into planning?

Sometimes there are no official management plans at all and deviations from recommended evaluation methods are needed. Hockings (1998, 345) has a clue for this case also. If there are no specific desired outcomes declared, then evaluation will only consider the adequacy of management inputs and processes. It could furthermore produce a set of independent norms, which will help the management of the protected area to compare them with the actual conditions and (unofficial) goals and objectives.

Hockings’ circle of evaluation and management could also be used very practical as main structure to evaluate such an unofficial planning process, but has to be rather done by the management and its co-workers itself, than by external expertise.
Leverington et al. (2010, 42) state that “Both evaluation and planning for better management need to understand the inter-relationships between the threats, and to identify their root causes, if effective and sustainable solutions are to be devised and implemented.”

In their global study they recorded over 9000 assessments of protected area management effectiveness evaluation (PAME) from 140 countries, analysed for about half of these, and in addition reviewed over 50 evaluation reports. They recommend that “managers need to build better proactive management capacity, linking management planning, actions, research, monitoring, and evaluation. All these factors scored poorly, are correlated with effective management overall, and were regularly mentioned in reports as needing attention.” (viii)

Hockings et al. (2006, 37-40) also recommend a thorough and practicable finishing of the evaluation, starting with the analyses of results. Doing this one can find important relationships between drivers and forces of the management cycle. It should identify reasons and factors of outcomes, if they were planned or rather happened without management control. This thoroughly understanding of causes will effectively improve the performance. Afterwards, key conclusions should be drawn, which will highlight recommendations, for example showing gaps of knowledge or favourable future project topics.

These results will be then communicated in one or several reports, adapted concerning the respective partner interest and competence. But also public relation material like brochures, presentations or field trips with stakeholders or other interest groups should be considered.

Hockings et al. (2006, 42) also stress that “two key factors determine whether evaluation findings will make a practical difference to management: (1) a high level of commitment to the evaluation by managers and owners of the protected areas and (2) adequate mechanisms, capacity and resources to address the findings and recommendations.”

They conclude that good management comes from understanding the individual condition of a protected area and requires a thorough analyse of the regular monitoring. At least the evaluation of the implementation should be done by external experts and its results well transferred to all levels of involved personnel.

Minimum requirements

- Write a short report about the strengths and weaknesses of the existing management plan.
- Provide a synopsis of descriptions and instructions (goals, objectives, strategies and measures) for the selected CAMP areas inside the investigation area.
- List all deviations from the plan to current management practices and intentions.
- Give a summary of any definitions, plans, projects or actions inside the investigation area regarding climate change.
3.1.4. Stakeholder Dialogue

Introduction

Conservation management is depending on and influence by the social, political and economic context of protected areas and the communities living therein. Adaptation efforts therefore need to take local conditions into consideration and reflect the social, political and economic factors. Land use is one of the most important impacts on habitats. Conservation status of many habitats is depending on type and intensity of land-use practices like agriculture, forestry or recreation. Adaptation measures will affect these land-use practices either to mitigate negative impacts of climate change or to increase habitat resilience by reducing non-climate stressors. Implementation of strategies and measures will only be possible with the support of local stakeholder. Including them in the assessment of problems, impacts and the elaboration of measures is a prerequisite for this.

Many communities are already experiencing impacts of climate change and local land use is adapted to this as well as to changing social and economic conditions. This autonomous adaptation can either counteract or support planned adaptation efforts in conservation management. The assessment and guidance of autonomous adaptation is essential for the effective management of climate-change impacts. Consequentially, there is a need to ensure suitable participatory modalities for the development of CAMPs.

Stakeholder involvement should facilitate learning and responding processes as part of an iterative planning cycle. It should support all phases of the CAMP process. The local knowledge and information should be used in the identification of current and future climate related problems, but can also support the analysis of drivers, pressures and impacts. Finally the identification, localization and implementation of adaptation measures need the support of local land users. Awareness rising for the impacts of climate change, their interaction with other non-climate pressures and the need for adaptation is an essential objective of the stakeholder involvement. It must be based on the understanding that adaptation as a constant process and not a one-off intervention.

Goals and expected outcome

Stakeholder participation in a CAMP process should be geared towards the following main objectives:

- To raise awareness for local impacts of climate change and the need for planned adaptation
- To include local knowledge on problems, impacts and autonomous adaptation in the CAMP
- To strengthen habitat resilience through guidance of autonomous adaptation and reduction of non-climatic land-use pressures
- To improve the public support of local adaptation actions
- To help finding and implementing win-win-solutions for land users and nature conservation
Methods

The HABIT-CHANGE project is covering a wide geographical range with different nations and communities, but the implementation of stakeholder involvement in the CAMP process must be highly context specific. Different communities have different levels of knowledge, different social dynamics and different ways of communicating concepts. Hence, there is no general approach to stakeholder involvement applicable in all investigation areas. Stakeholder involvement in a CAMP process can have different degrees. In the most comprehensive sense it can mean the intensive involvement of all relevant groups in the entire CAMP process, from the agenda setting, definition of objectives, through to the assessments of impacts down to the elaboration of measures. In other cases it might cover the participation focused on data collection, the refinement of methods, or discussion of objectives.

The minimal requirement on stakeholder involvement is the information and discussion of CAMP results in the investigation areas.

There are different steps of the CAMP process, where involvement of stakeholders might be useful:

- Stakeholder involvement in the process of agenda setting. Goals and objectives of the CAMP process should be discussed (e.g., which topics should be addressed? Which area should be covered?).
- Stakeholder involvement in inventory of existing data and data collection. Local impacts of climate change and other non-climate related pressures like land use should be identified. Local knowledge (e.g., on phonological dates important for agricultural practices like spring break, date of first moving) can be a valuable source of information.
- Stakeholder involvement in the assessment of climate change impacts. A community based assessment can help to identify local climatic trends and start the discussion about potential future impacts.
- Stakeholder involvement in the adaptation of strategies and measures. It should be geared towards awareness raising and strengthen public support for planned adaptation. Participation in this phase can help to identify win-win situations and measures easy to implement.

There is a wealth of literature on the mobilisation of stakeholders in community based processes (e.g., GICBA, http://www.weadapt.org/initiative/13). They might not be focused directly on adaptation of conservation management, but they provide helpful resources and examples for the application of different methods. Helpful guidelines to different methods applicable in the context of stakeholder involvement can be found in:

icimod-framework_for_community-based_climate_vulnerability_and_capacity_assessment_in_mountain_areas.pdf.


- WWF 2009: Climate witness community tool kit, WWF South Pacific: Suva (Fiji), available online at http://wwf.panda.org/about_our_earth/all_publications/?uNewsID=162722.

Also the Ecosystem Based Management tools Network (EBM) is providing a useful overview on tools for stakeholder involvement. These tools are divided into sections according to function (EBM 2011, http://ebmtoolsdatabase.org/resource/climate-change-vulnerability-assessment-and-adaptation-tools):

- “Process Tools: are those that will help a community design and conduct a planning process that incorporates the unique elements that address the vulnerabilities, risks and uncertainties inherent in climate-related planning.

- Visualization Tools: allow users to build unique tools and simulations that enable stakeholder engagement through the use of pictures or web-based tools. The tools in this group are generally simple to use, but can include web-based GIS visualization tools that require special software, hardware and expertise.

- Socio-economic Tools: provide community level socio-economic data that allows planners and stakeholders to visualize, explore, and understand the social impacts that could result from future hazards and climate change.

- Analytical Tools: allow planners to investigate current conditions and ecosystem processes, determine the effects of potential future conditions, and explore scenarios to determine potential effects of planning decisions. These are the most technically challenging of the tools, often requiring GIS software, expertise and training.”

In addition, HABIT-CHANGE will develop guidelines for stakeholder seminars. A thematic workshop in October 2011 will focus on stakeholder involvement in the CAMP process. Results will be available on the HABIT-CHANGE website.

**Minimum requirements**

Effective stakeholder involvement must reflect the needs and priorities of those affected by climate risks, and by adaptation activities. This requires information about relevant stakeholders:

- Who are the main land users in the investigation area (e.g., farmers, tourists, hunters)?
• Who are other important decision makers influencing land use in the area (e.g., land owner, local politicians, and tourism companies)?

• Which institutions influence communities and land use in the area?

In HABIT-CHANGE at least one stakeholder seminar should be included in the CAMP process.

3.1.5. Impact assessment

Introduction

The main objective of this working step is to find out what effects a changing climate will have on protected habitats. Beside this the effects of management actions (strategies and measures) on protected habitats or their conservation status are subject of this working step. During the development of climate-change adapted management plans (CAMPs) the assessment of impacts of climate change has to be done first. In a second step the impacts of different management strategies and measures have to be evaluated.

“Climate change impacts are defined by (1) the character and magnitude of climate changes likely to affect a given location, and (2) the sensitivity of a given conservation target to climate change” (West et al. 2009, 1003) Different kind of information is needed for an assessment of climate-change impacts as it proved successful in other projects:

“Two variables – exposure to climate change and sensitivity to climate change – were the basic elements used in the assessment of climate change impacts on species and habitats. When considered together, these provided a semi-qualitative measure of impact.” (HARLEY et al. 2010, 5)

• Definition exposure: “the nature and degree to which a system is exposed to climatic variations” (HARLEY et al. 2010, 4)

• Definition sensitivity: “the degree to which a system is affected, either adversely or beneficially, by climate change” (HARLEY et al. 2010, 4)

Goals and expected outcome

Impact assessment in a CAMP process should be geared towards the following main objectives:

• Generation of spatially explicit information about the sensitivity of protected habitats in the investigation area
• Generation of spatially explicit information about the climate-change exposure in our investigation areas (how will temperature and precipitation and other climate related parameters change in the area?)

• Estimation of the impacts of climate change on protected habitats by bringing information about habitat sensitivity and climate-change exposure together

• Estimation of impacts of climate change on protected habitats taking also information about existing and expected land-use pressures into account

• Estimation of impacts of different management options on habitats: which strategies and measures seem to be the most effective and efficient to reduce impacts of climate-change pressures (and impacts of land-use pressures)

Methods

Basis for the impact assessment shall be the “potential impact maps”. The methodological framework for the development of these maps is described in output 4.3.5 and 4.6.3. The assessment of climate-change impacts on habitats uses climate scenarios, hydrological scenarios and other outputs from WP 3 and WP 4 (stakeholder dialogues and existing pressure)

A methodological challenge will be the analyses of impacts of changes in different climate parameters (like mean temperature, seasonal precipitation, and climatic water balance, see list in output 3.2.3) on the different natural assets like soil, water, plant species etc. Such kind of systematic assessment could be the basis for estimating the impacts on protected habitats that always consist of a variety of plant communities that depend on certain soil, water and climate conditions.

It is important to show the expected changes in different climate parameters (e.g., more rainfall in summer) and their impacts on the different components of the ecosystem (e.g., soil), including the intensity of impact (e.g., massive erosion). The impacts can be positive or negative. Due to that it is for example important to assess the sensitivity of subjects of protection, like flora, fauna, soil and water, in the CAMP area. The expected result shall be the evaluated status of habitats after occurred impacts.

Information about the exposure (how will climate change?) and the habitats (conservation status, sensitivity) have to be available for the assessment.

Output 3.2.3 shows predicted trends in climate and climate scenarios for the different regions the conservation areas lying inside. It gives information about monthly changes in temperature, precipitation, and climatic water balance for three time periods 2011-2040, 2041-2070 and 2071-2100. The findings can be used for appraisal of other CC-related pressures. The following list shows potential climatic parameters which can be consider for impact assessment
CC-related pressures (corresponding to output 3.2.5):

- Increasing annual mean temperature
- Increasing winter temperature
- Increasing summer temperature
- Decreasing frequency of frosty days in autumn and in spring
- Increasing number of frosty days / Longer frosty periods in winter
- Early / late frost
- Number of sunny hours / Decreasing cloud cover (stronger radiation – higher evapotranspiration)
- Increasing length of vegetation period
- Altering annual rain distribution
- Low water table
- Decreasing or Increasing mean precipitation
- Decreasing snowfall / snow cover
- Thick snow layers
- Longer rainless periods
- Frequent meteorological anomalies and extremities
- Heavy rains
- Flooding events
- Heat waves
- Drought
- Wildfires
- Storms (strong wind blows)

Detailed requirements for the evaluation of management measures have been discussed within the development of output 3.4.1. Please refer to the draft version of output 3.4.1 for more specific details for the evaluation of management impacts. Additional information
Minimum requirements

- Compile a list of habitat types that exist in the CAMP area and evaluate the expected impacts of climate change
- Provide sufficient data for the production of “potential impact maps” (output 4.3.5 and 4.6.1)
- Check and evaluate the results of the potential impacts maps if results are really valid and plausible
- Compile information about the impacts of management measures for protected habitats, evaluate management measures as they are compiled in output 3.3.1
- Support the process of evaluation of existing and new management measures and strategies in output 3.4.1

3.1.6. Adaptation of strategies and measures

Introduction

This working step is direct relation to the analysis and evaluation of the existing management plan (see above 3.1.3). The evaluation of existing strategies and measures for the management of protected habitats helped to identify those strategies and measures that are expected to be effective and efficient even under conditions of climate change. The strategies and measures that are already implemented in the investigation areas have to be supplemented by new and adapted strategies and measures as they are recommended in relevant publications (see output 3.3.1). Based on the defined objectives, strategies and measures in output 3.3.1 new and adapted ones shall be developed with regard to climate change and its impacts. These new and adapted objectives, strategies and measures have to be integrated into existing management.

The variety of existing and new strategies and measures can be categorised according to the main target of the strategy. We distinguish between the following categories of strategies and measures:

- Strategies related to land and water protection and management
- Strategies related to monitoring and planning
- Strategies related to law and policy
- Strategies related to stakeholder and land user, public relation and awareness
- Strategies related to Knowledge and research, Science and technology
- Strategies related to species conservation
One of the main challenges in the adaptation of strategies and measures is caused by the fact that in most protected areas a systematic monitoring of the implementation and success of strategies and measures is still missing. Also, the new and adapted strategies and measures proposed in relevant publications are not yet tested either. “It is important to note that the strategies discussed under these approaches are options, not recommendations; the efficacy of many of the individual strategies has yet to be fully tested and would depend on the specifics of place, ecosystem, project design, etc.” (WEST et al. 2009, 1005) They present as wide choice of options that are supposed to be appropriate for a climate-change adapted management but their effectiveness and efficiency still has to be proven.

At the same time management decisions under climate-change have to deal with uncertainties that exist on many different levels: uncertainties in climate change scenarios, uncertainties about the impacts of climate change on protected habitats and uncertainties about the effectiveness and efficiency of management strategies and measures.

“The high degree of uncertainty inherent in assessments of climate change impacts can make it difficult for a manager to translate results from those assessments into practical management actions (Dessai et al., 2009). However, uncertainty is not the same as ignorance or lack of information – It simply means that there is more than one outcome possible as a result of climate change. Fortunately, there are approaches for dealing with uncertainty that allow progress.” (WEST et al. 2009, 1004)

One of the general and comprehensive concepts or strategies to deal with uncertainties mentioned above and to address the targets of the categories introduced above is the (active) adaptive management. We consider adaptive management as a general approach for the management of protected areas under climate change that allows integrating many different strategies and measures. Therefore the main principles and working steps of an adaptive management are described in extent.

3.1.7. Implementation of Adaptive Management

Introduction

Adaptive management is one of the most recommended strategies to deal with climate change. It “allows managers to determine systematically whether management activities are succeeding or failing to achieve objectives.” (WILLIAMS et al. 2009, 57) It requires a consistent structure and organisation of the management process that has to be prepared carefully. “Adaptive management in the context of climate change involves the consideration of potential climate impacts, the design of management actions that take those impacts into account, monitoring of climate-sensitive species and processes to measure management effectiveness, and the redesign and implementation of improved (or new) management actions.” (WEST et al. 2009, 1010) Stakeholder involvement is also an important element during the set-up phase of an Adaptive Management.
Goals and expected outcome

Main feature of an active adaptive management is the implementation of different alternative management options at the same time and the systematic monitoring of the effectiveness and efficiency of those options. In that way managers can reduce the uncertainty about possible system responses and gain knowledge about processes and functioning of habitats and ecosystems.

Methods

To establish an adaptive management in a protected area many processes and framework conditions have to be rearranged. This comprehensive process may be obstructed by several barriers that may be overcome by certain opportunities. “Barriers and opportunities can be divided into four categories: (1) legislation and regulations, (2) management policies and procedures, (3) human and financial capital, and (4) information and science.” (West et al. 2009, 1011)

The following tables from West et al. 2009 shall help management authorities to identify potential barriers and evaluate the chances for an implementation of adaptive management.

First step in the CAMP process is the identification of potential barriers and their evaluation. Only if barriers can be overcome e. g. by intensified stakeholder dialogues, it is recommended to start the implementation of the Adaptive Management concept in the CAMP process.

Table 4: Examples of legislation and regulation as barriers to and opportunities for adaptation
(Source West et al. 2009, 1011)

<table>
<thead>
<tr>
<th>Perceived barrier</th>
<th>Opportunity</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legislation and agency policies may be highly static, inhibit dynamic planning,</td>
<td>Re-evaluate capabilities of, or authorities under, existing legislation to</td>
<td>• Use state wildlife action plans to manage lands adjacent to national wildlife refuges to enable climate-induced species emigration (Scott and others 2008)</td>
</tr>
<tr>
<td>impede flexible adaptive responses and force a fine-filter approach to management</td>
<td>determine how climate change can be addressed within the legislative</td>
<td>• Incorporate climate change impacts into priority setting for designation of new wild and scenic rivers (Palmer and others 2008)</td>
</tr>
<tr>
<td></td>
<td>boundaries</td>
<td></td>
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</tbody>
</table>
### Table 5: Examples of management policies and procedures as barriers to and opportunities for adaptation
(Source West et al. 2009, 1012)

<table>
<thead>
<tr>
<th>Perceived barrier</th>
<th>Opportunity</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Seasonal management activities may be affected by changes in timing and duration of seasons | Review timing of management activities and take advantage of seasonal changes that provide more opportunities for adaptation | - Take advantage of shorter winter seasons (longer prescribed fire season) to do fuel treatments on more national forest acres (Julius and others 2008)  
- Where guidelines are flexible for meeting strategic planning goals (e.g., maintain biodiversity), re-prioritize management actions to address effect of climate change on achievement of goals (Julius and others 2008) |
| Agency policies do not recognize climatic change as a significant problem or stressor | Take advantage of flexibility in planning guidelines and processes to incorporate adaptation to climate change |                                                                                                                                          |
| Political boundaries do not necessarily align with ecological processes; some resources cross boundaries; checkerboard ownership pattern with lands alternating between public and private ownership at odds with landscape-scale management (see Joyce and others 2008) | Identify management authorities with similar goals and adjacent lands; share information, create coalitions and partnerships that extend beyond political boundaries to coordinate management; acquire property for system expansion | - Implement active management at broader landscape scales through existing multi-agency management processes such as (1) the Herger-Feinstein Quincy Library Group Pilot and the FPA Adaptive Management project on Tahoe National Forest (Julius and others 2008), (2) the Greater Yellowstone Coordinating Committee, and the Southern Appalachian Man and the Biosphere Program with relationships across jurisdictional boundaries (Baron and others 2008), (3) The Delaware River, managed cooperatively as a partnership river (Julius and others 2008)  
- Coordinate dam management at the landscape level for species that cross political boundaries using dam operations prospectively as thermal controls under future climate changes (Palmer and others 2008) |
Table 6: Examples of human and financial capital as barriers to and opportunities for adaptation
(Source West et al. 2009, 1013)

<table>
<thead>
<tr>
<th>Perceived barrier</th>
<th>Opportunity</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Lack of incentive to take risks, develop creative projects; reward system focuses on achieving narrowly prescribed goals; funds allocated encourage routine, easily accomplished activities | Shift from a culture of punishing failure to one that values creative thinking and supports incremental learning and gradual achievement of management goals | • Build into performance expectations of a gradient between success and failure (Baron and others 2008)  
• Set up a systematic method for (1) learning from mistakes and successes, and (2) eliciting the experience and empirical data of front line managers, resource management personnel, and scientific staff (Baron and others 2008) |
| Little to no climate expertise within management units at regional and local levels; disconnect between science and management that impedes access to information | Use newly created positions or staff openings as opportunities to add climate change expertise; train resource managers and other personnel in climate change science | • Develop expertise through incorporation into existing Forest Service training programs, such as the silvicultural certification program, regional integrated resource training workshops, and regional training sessions for resource staffs (Joyce and others 2008)  
• Develop managers’ guides, climate primers, management toolkits, a Web clearinghouse, and video presentations (Joyce and others 2008) |
| National and regional budget policies constrain the altering or supplementing of current management practices to enable adaptation to climate change; general decline in staff resources and capacity | Look for creative ways to augment the workforce and stretch budgets to institute adaptation practices (e.g., individuals or parties with mutual interests in learning about or addressing climate change that may be engaged at no additional cost) | • Augment budget and workforce through volunteers from the public or other sources such as institutions with compatible educational requirements, neighborhood groups, environmental associations, etc., such as the Reef Check Program that help collect coral reef monitoring data (Keller and others 2008)  
• Identify organizations or citizens that benefit from adaptation to share implementation costs in order to avoid more costly impacts/damages (Julius and others 2008) |
This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

Table 7: Examples of information and science as barriers to and opportunities for adaptation
(Source West et al. 2009; 1014)

<table>
<thead>
<tr>
<th>Perceived barrier</th>
<th>Opportunity</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often no inventory or baseline information exists, and nothing is in place to detect climate change impacts</td>
<td>Identify existing monitoring programs for management; develop a suite of climate change indicators and incorporate them into existing programs</td>
<td>• Use programs such as the National Park Service vital signs for the Inventory and Monitoring Program, Global Fiducial Program, Long Term Ecological Research networks, and National Ecological Observatory Network to monitor climate change impacts and effectiveness of adaptation options (Baron and others 2008)</td>
</tr>
<tr>
<td>Historic conditions may no longer sufficiently inform future planning (e.g., “100-year” flood events may occur more often)</td>
<td>Evaluate policies that use historic conditions and determine how to better reflect accurate baselines in the face of climate change; modify design assumptions to account for changing climate conditions</td>
<td>• Change emphasis from maintenance of “minimum flows” to the more sophisticated and scientifically based “natural flow paradigm,” as is happening in some places (Palmer and others 2008)</td>
</tr>
<tr>
<td>Lack of decision support tools, uncertainty in climate change science, and gaps in scientific data limits assessments of risks and efficacies</td>
<td>Identify and use all available tools/mechanisms currently in place to deal with existing problems to apply to climate-change related impacts</td>
<td>• Hedge bets and optimize practices in situations where system dynamics and responses are fairly certain (Baron and others 2008)</td>
</tr>
<tr>
<td>Occurrence of extreme climate events outside historical experience</td>
<td>Use disturbed landscapes as templates for “management experiments” that provide data to improve adaptive management</td>
<td>• Use adaptive management in situations with greater uncertainty (Baron and others 2008)</td>
</tr>
<tr>
<td>Stakeholders have insufficient information to properly evaluate adaptation actions, and thus may oppose/prevent implementation of adaptation (e.g., salvaging harvests after disturbance). Appeals and litigation from external public results in no action</td>
<td>Inform public and promote consensus-building on tough decisions; invite input from a broad range of sources to generate buy-in across stakeholder interests</td>
<td>• After fire, reforest with genotypes that are better adjusted to the new or unfolding regional climate with nursery stock tolerant to low soil moisture and high temperature, or with a variety of genotypes (Joyce and others 2008)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Conduct public outreach activities with information on climate impacts and adaptation options—including demonstration projects with concrete results—through workshops, scoping meetings, face-to-face dialog, and informal disposition processes to increase buy in for management actions (Julius and others 2008)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use state and local stakeholders to develop management plans to gain support and participation in implementation and oversight of planting activities, as do the National Estuaries (Peterson and others 2008), the Coastal Habitat Protection Plans for fisheries management (Peterson and others 2008), and some National Forests (Joyce and others 2008)</td>
</tr>
</tbody>
</table>

“Implementation of adaptive management can be described in terms of two phases: a set-up phase in which its key components are developed, and an iterative phase in which the components are linked together in a sequential decision process. The set-up phase has five structural elements, namely stakeholder involvement, management objectives, potential management actions, predictive models, and monitoring plans. The iterative phase uses these elements in an ongoing cycle of learning about system structure and function, and managing based on what is learned.” (WILLIAMS et al. 2009, 21)
The process and important elements of an Adaptive Management have been introduced during the partner meeting in Balatonfüred, Hungary. The following table lists key points and key questions that describe each element of the Adaptive Management. These questions and key points may help to identify barriers and chances and calculate the required resources for an Adaptive Management.

“The implementation of adaptive management can be facilitated by considering a series of questions related to the success criteria and the operational steps.” (Williams et al. 2009, 57)

**Table 8: Eight steps with relevant key points and key questions for successful implementation of adaptive management**

(Source Williams et al. 2009)

<table>
<thead>
<tr>
<th>Set-up phase</th>
<th></th>
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<tbody>
<tr>
<td><strong>Step 1 – Stakeholder involvement:</strong> Ensure stakeholder commitment to adaptively manage the enterprise for its duration</td>
<td></td>
</tr>
<tr>
<td><strong>Key Points</strong></td>
<td></td>
</tr>
<tr>
<td>• A strong effort must be made to identify and engage the appropriate stakeholders.</td>
<td></td>
</tr>
<tr>
<td>• All phases of the adaptive management process must be open, transparent, and accessible to stakeholders.</td>
<td></td>
</tr>
<tr>
<td>• Stakeholders must strive for agreement on scope, objectives, and management alternatives for the adaptive management application.</td>
<td></td>
</tr>
<tr>
<td>• Stakeholders must commit to a process for adjusting management strategy over time, based on resource status and learning.</td>
<td></td>
</tr>
<tr>
<td>• Stakeholder organizations must be encouraged to commit time and energy to adaptively manage the resource over the agreed-upon timeframe.</td>
<td></td>
</tr>
<tr>
<td>• Stakeholders must commit resources for monitoring and assessment, in addition to decision making.</td>
<td></td>
</tr>
</tbody>
</table>
### Step 1 – Systematic Process Development

**Key Questions**
- Has a systematic process been developed that facilitates effective participation by stakeholders?
- Have key stakeholders been identified?
- Have agreed upon lines of communication been established and is their importance to successful adaptive management processes understood?
- Are stakeholders committed to and involved in the adaptive management process including the monitoring and assessment program?
- Is the adaptive management process able to adapt to changes in stakeholder and public viewpoints?

### Step 2 – Objectives

**Identify clear, measurable, and agreed-upon management objectives to guide decision making and evaluate management effectiveness over time**

**Key Points**
- Objectives substantively influence decisions and management strategies.
- Objectives should incorporate the social, economic and/or ecological values of stakeholders, and reflect the value of learning over time.
- To be useful as guides for decision making and evaluation, objectives should be specific and unambiguous, measurable with the appropriate field data, achievable but challenging, results-oriented, and applicable over the timeframe of the enterprise.

**Key Questions**
- Have explicit and measurable management objectives been identified and developed?
- Are the management objectives achievable and sustainable?
- Have performance metrics relating to the management objectives been developed?
- Has a system of monitoring and assessment relevant to the management objectives been developed and implemented so that progress in meeting the objectives can be tracked?
- Have tradeoffs among management objectives been considered and are they understood?

### Step 3 – Management actions

**Identify a set of potential management actions for decision making**

**Key Points**
- Potential actions consist of activities under management control (for example, harvest, stocking, restoration).
- Alternatives typically focus on alterations of resource status or process rates.
- The suite of available actions should be designed to promote learning.
- The alternatives should be explicit and documented.
- Stakeholders should participate in the identification of alternatives.

**Key Questions**
- Has a range of potential management actions been developed?
- Have the specific tasks to implement the management alternatives been identified?
- Is the range of potential actions appropriate for the timeframe under which changes are likely to occur?
- Can the set of management alternatives be adjusted through time if needed?

### Step 4 – Models

**Identify models that characterize different ideas (hypotheses) about how the system works**

**Key Points**
- Models in adaptive management should characterize system behaviours and responses to management actions.
- Models should incorporate different ideas (hypotheses) about how the resource system works and...
how it responds to management.

- The suite of models should capture key uncertainties (or disagreements) about resource processes and management effects.
- Models must be compatible with, and calibrated to, available data and knowledge.

**Key Questions**

- Are the hypotheses underlying the strategies for resource management expressed as testable models?
- Have explicit links between management actions and resource dynamics been incorporated into the models?
- Are the ecological/resource processes that drive resource dynamics understood?
- Are the relevant environmental factors incorporated into the models?
- Are the models calibrated with available information?

**Step 5 – Monitoring plans: Design and implement a monitoring plan to track resource status and other key resource attributes**

**Key Points**

- A monitoring plan should be designed to estimate system state and other attributes needed for decision making and evaluation.
- The plan should promote learning through a comparison of estimates against model-based predictions.
- The plan should be efficient, in that it produces estimates that have maximum precision for a given cost, or minimum cost for a given level of precision.

**Key Questions**

- Will the monitoring plan support the testing of alternative models and measurement of progress toward accomplishing management objectives?
- Is it clear what monitoring data need to be collected to estimate the relevant resource attributes?
- Has the level of accuracy that is needed been identified?
- Are commitments among managers, scientists, and other stakeholders in place to sustain an ongoing monitoring and assessment program?
- Will meaningful and useful data and information be available within timeframes that allow for adaptive decision making?

**Iterative phase**

**Step 6 – Decision making: Select management actions based on management objectives, resource conditions, and understanding**

**Key Points**

- At each point in time, selection of a management action is made from the set of possible alternatives.
- The selection of a management action is guided by objectives, which are used to evaluate alternatives and identify an action that contributes to meeting the objectives.
- The appropriate action depends on resource status and the current level of understanding about resource dynamics.
- Management is adjusted over time as resource conditions change and understanding evolves.

**Key Questions**

- Is it clear how decisions will be made?
- Are decisions at each point in time based on the current status and understanding of the resource?
- Are decisions being guided by management objectives?
- Are stakeholders informed and consulted before decisions are made or changed?

**Step 7 – Follow-up monitoring: Use monitoring to track system responses to management actions**

**Key Points**
- Monitoring typically occurs after management interventions.
- Resource status and other key indicators of impacts are estimated with monitoring data.
- Estimates based on monitoring data are used to evaluate management impacts and inform decision making at the next decision point.
- Because the amount of monitoring data increases over the course of an application, the amount of information about system processes also increases.

**Key Questions**
- Are the analysis needs understood?
- Is monitoring conducted on a timely basis?
- Is monitoring targeted to system attributes that are useful for evaluation and learning?
- Are monitoring data collected and managed so that they are available and easy to access?
- Can the monitoring data be used to update the measures of model confidence?

**Step 8 – Assessment: Improve understanding of resource dynamics by comparing predicted and observed changes in resource status**

**Key Points**
- Assessment/analysis includes parameter estimation, comparative assessments, and prioritization of management alternatives.
- Comparison of predicted and actual responses is used to update understanding of management impacts.
- Comparison and ranking of projected outcomes for management alternatives is used in selection of management actions.
- Comparison of desired and actual outcomes is used to evaluate management effectiveness.

**Key Questions**
- Have the expected impacts of alternative management strategies been evaluated?
- Is it clear how results are to be understood and interpreted?
- Have thresholds that indicate a change in management been recognized?
- Have the action(s) to be taken when a threshold is reached been identified?

**Step 9 – Iteration: Cycle back to Step 6**

**Key Points**
- The cycle of Steps 6 through 9 is iterated until the end of the timeframe.
- Iterations can begin at any point in the cycle; however a natural entry point is with decision making.
- The direct linkage from assessment to management action in Figure expresses the contribution of learning to decision making, by providing information on which to base smart decisions.
- The two-step linkage from management action to assessment in Figure expresses the contribution of management to learning, through interventions that are useful in investigating the resource system.
Figure 4: Iterative cycle of adaptive management. Management actions are based on objectives, resource status, and learning. Data from follow up monitoring are used to assess impacts and update understanding. Results from assessment guide decision making in the next time period.

(Source Williams et al. 2009, 36)

Key Questions
- Are management actions and decisions reviewed frequently based on monitoring and assessment?
- Have incentives been developed to encourage experimentation and learning?
- Have resource management alternatives been revisited and/or modified over time?
- Has uncertainty related to resource dynamics and the impacts of management actions been reduced through learning over time?
- Are the targets identified in the performance metrics likely to be achieved within the specified timeframe?

In the CAMP-process in the HABIT-CHANGE project only the set-up phase will be relevant, though the iterative phase has to be prepared well in the management plan, too. The working steps or components “stakeholder involvement” and discussion and definition of “management objectives” are described above in chapter 3.1.1 and 3.1.4.

Minimum requirements
- Check what barriers exist or may exist in your respective CAMP area and evaluate the identified barriers.
- Suggest measures and strategies to overcome the barriers.
- Document the process of identification and evaluation of potential barriers.
- Define questions and problems that you expect when implementing Adaptive Management and communicate them with supporting scientific partners and other investigation areas.
3.2. Optional working steps

3.2.1. Habitat mapping

The HABIT-CHANGE outputs 3.1.6 and 3.1.7 are related to habitat mapping and show that the spatial explicit delineation and the assessment of habitats within a conservation area are necessary for spatial management purposes and to fulfil spatial valid conservation regulations (e.g. national biotope mapping initiatives or EU regulations like the EC Habitat Directive, see Figure 5).

![Figure 5: Output 3.1.7a: Habitat Map of Balaton Uplands NP, showing Naturalness, Hungarian and Natura 2000 habitat types in enlarged scale.](image)

The mapping process can be done either by manual interpretation of remote sensing images (e.g. aerial images) or by automated image processing approaches (e.g. pixel-based classification of satellite images). Both classification approaches strongly depend on vegetation surveys. The field data, which is collected in these surveys, is related to the overall objective of the habitat mapping. GPS points with species lists can be used for monitoring purposes as done in Output 3.1.9 for the NP Bucegi. Mostly, more detailed phyto-sociological survey methods (like recommended for the EC Habitat Directive assessment) are used to describe the characteristic vegetation composition of habitats. These methods include beside species lists (presence/absence) also quantitative information’s like species abundance, vegetation density or vegetation structure.
3.2.2. Adaptation of monitoring

As described above in chapter 3.1.6 adaptive management relies on extensive monitoring activities to be successful. Monitoring is already part of the management of protected areas but as output 3.1.4 shows monitoring activities do not yet consider climate change and often are not frequently established programmes. Additionally, most monitoring activities aim at species conservation status but not at habitats or at the control and evaluation of management measures.

How an effective and efficient monitoring for habitats under climate change should look like was subject of several outputs in work package 4. Indicators for the monitoring were identified and recommended. The information in the indicator-outputs now has to be integrated into the existing monitoring activities. To establish an adaptive management indicators for all relevant strategies and measures have to be identified. For the implementation of monitoring a long-term programme should be developed.

More information about an effective monitoring of climate-change related changes has to be specified during the process of adapting the existing management plans.

4. Conclusion and Outlook

This report serves as a manual and guidebook for the first steps in adapting existing management plans during the CAMP-process. Methodological approaches for some basic working steps are offered. Knowing that a wide variety of different approaches is discussed in literature we made a selection of techniques and methods that fit the framework of the HABIT-CHANGE project best. Nevertheless: each CAMP area faces different and specific starting points and has slightly different objectives for the process of adaptation. Therefore this report is meant as a support of all relevant partners. The presented techniques do not necessarily have to be adopted by all CAMP areas but they can make things easier. They also allow us to compare the process of adaptation in different investigation areas.

The experiences with the suggested methods and techniques will be discussed and evaluated. They will be the basis for the list of recommendations (output 6.1.2) and the management handbook (output 5.3.2).

When all CAMP areas can fulfil the minimum requirements the project has a rich information basis for the development of guidelines and handbooks that may help other protected areas all over Europe to adapt their management plans to climate change.
5. Literature


